

4.0 AFFECTED ENVIRONMENT

The ORNL is one of three primary industrial sites [the East Tennessee Technology Park (ETTP), the Y-12 National Security Complex, and the ORNL] on the ORR and is located within Anderson and Roane counties in east Tennessee. The ORR is a tract of government-owned land of approximately 13,931 ha (34,424 acres). Most of ORNL's developed areas (also commonly referred to as X-10) encompass facilities in two valleys (Bethel and Melton) on approximately 1,720 ha (4,250 acres) of land within the ORR. ORNL facilities are also located on other parts of the more than 8,498 ha (21,000 acres) for which ORNL is responsible, including some at the nearby Y-12 National Security Complex and field research areas. It is approximately 20 kilometers (km) [12.5 miles (mi)] west-northwest of Knoxville, 19 km (12 mi) southwest of Clinton, and 16 km (10 mi) northeast of Kingston.

The ORNL is bounded by the Tennessee Valley Authority (TVA) Melton Hill Reservoir and the Clinch River to the south, the ETTP to the northwest, the Y-12 National Security Complex to the northeast, and sparsely developed commercial properties to the east. The nearest center of population is the residential section of Oak Ridge, which borders ORR to the north and east. The nearest residents to the ORNL are located in rural residential areas about 4 km (2.5 mi) to the south and southwest of ORNL across the Clinch River. Land uses surrounding ORR are primarily forestry, agriculture, residential, commercial, industrial, and transportation. Land uses surrounding the main ORNL site are primarily environmental research, forest buffer, and firing range safety zones.

4.1 CLIMATE AND TOPOGRAPHY

The climate of ORR is characterized by warm, humid summers and cool, wet winters. Extremes in temperature, annual precipitation, and winds are uncommon. The ORR climate is moderated by the influence of the Cumberland Mountains to the west and the Great Smoky Mountains to the east. During winter, the Cumberland Mountains have a moderating influence on the local climate by retarding the flow of cold air from the north and west. During summer, the Great Smoky Mountains divert the hot winds emanating from the Atlantic coast.

The mean annual temperature in Oak Ridge between 1963 and 1993 was 14.3°C (57.5 °F). The coldest month is usually January, with temperatures averaging 2.8°C (37°F) and lows occasionally reaching -18°C (0°F). The warmest month is usually July, with temperatures averaging 25.2°C (77°F) and highs occasionally reaching 38°C (100°F). Temperatures of 38°C (100°F) or higher have occurred during less than half of the years of the period of record, and temperatures of -18°C (0°F) or below are rare. Daily temperature fluctuations are typically 5.6°C (22°F) (DOE 1999c).

Average precipitation in the Oak Ridge area varies from place to place by as much as 30 percent depending on the location relative to the local terrain. The 40-year annual average precipitation is 137 cm (53.75 in), including about 26 cm (10.4 in) of snowfall. Precipitation in the region is greatest in the winter and spring months (January through April) and least during the fall months (September through November), when high-pressure systems are more frequent.

The Oak Ridge area has relatively light winds compared to other parts of the United States. The Cumberland Mountains and the Plateau to the northwest and west, and the local valley-and-ridge topography divert severe storms and minimize air movement and local wind impact. Ridge-top and valley sites in the Oak Ridge area (excluding the Cumberland Mountains and the Plateau) experience wind speeds less than 5 meters per second (m/s) [11.2 miles per hour (mph)] over 90 percent of the time, and many valley-bottom sites experience winds less than 2 m/s (4.5 mph) over 70 percent of the time. Prevailing wind directions in the Oak Ridge area are primarily oriented to the direction of the local valley-and-ridge terrain. Prevailing winds are either up-valley (northeasterly) day-time winds, or down-valley (southwesterly) night-time winds (NABIR 2000).

ORR lies within the western portion of the Valley and Ridge Province, characterized by a series of northeast-southwest trending parallel ridges divided by relatively broad, intervening valleys. Bethel Valley, the main

ORNL site for this assessment, lies predominantly in a valley floor between two prominent ridges: Chestnut Ridge to the northwest and Haw Ridge to the southeast. The valley floor elevation ranges from about 229 m (750 ft) to about 256 m (840 ft). The axis of Bethel Valley is underlain by soluble rocks and in some areas, karst features such as sinkholes and closed surface depressions are visible. Slopes in the valley floor area are very gentle until they meet the edge of Bethel Valley where a series of knobs rise near the foot of Chestnut Ridge. The hill slopes increase rapidly onto the broad-crested Chestnut and Haw Ridges that have numerous knobs and incised valley streams. The highest ridge elevation is approximately 335 m (1,100 ft). The headwaters of White Oak Creek and Bearden Creek are both on Chestnut Ridge.

4.2 EARTH RESOURCES

Major valleys within the ORR include East Fork Valley, Bear Creek Valley, Bethel Valley, and Melton Valley. Major ridges within the ORR include Black Oak Ridge, East Fork Ridge, Pine Ridge, Chestnut Ridge, Haw Ridge, and Copper Ridge (LMER 1999a). In general, the ridges consist of resistant siltstone, sandstone, and dolomite units, and the valleys, which resulted from stream erosion, consist of the less resistant shales and shale-rich carbonates (DOE 1991).

4.2.1 Geology

Several geologic formations are present in the ORR area. A geologic map is shown in Figure 4.2.1–1. The Rome Formation, which forms the Pine Ridge, consists of massive to thinly bedded (layered) sandstones interbedded with minor amounts of thinly bedded, silty mudstones, shales, and dolomites. The thickness of the Rome Formation is uncertain at ORR because of the displacement caused by the White Oak Mountain Thrust Fault. The Conasauga Group, which underlies Bear Creek Valley and Melton Valley, consists primarily of calcareous shales, siltstone, and limestone. All five formations of the Knox Group have been identified at the ORR. The Knox Group, which underlies Chestnut Ridge to the north and Melton Hill and Copper Ridge to the south, is estimated to be approximately 732 m (2,400 ft) thick. The Knox Group consists of dolomites and limestones and weathers to a thick, orange-red, clay residuum (soil) that consists of abundant chert and contains karst features (DOE 1991).

Chickamauga Limestone, consisting of limestone, shaly limestone, calcareous siltstone, and shale, underlies Bethel Valley, East Fork Valley, and a narrow belt northwest of Pine Ridge. The Chickamauga formation is extremely variable, although the entire sequence is calcareous (consists largely of calcium). In Bethel Valley, the lithologic (geologic layers) differences within the formation are distinct. The Chickamauga in Bethel Valley can be divided into at least eight units consisting of redbeds, which are not represented in East Fork Valley (DOE 1999c).

Karst features are dissolutional features occurring in carbonate bedrock. Karst features represent a spectrum ranging from minor solutional enlargement of fractures to conduit flowpaths to caves large enough for a person to walk into. Numerous surface indications of karst development have been identified at ORR (Figure 4.2.1–1). Surface evidence of karst development includes sinking streams (swallets) and overflow swallets, karst springs and overflow springs, accessible caves, and numerous sinkholes of varying size. In general, karst with sinkholes and large cavities appears most developed in association with the Knox Group carbonate bedrock, whereas karst is less developed in the Chickamauga Group carbonates that underlie the Bethel Valley and the proposed project area (LMER 1999a). Cavities encountered in Chickamauga Group drilling are typically smaller and often clay-filled.

11x17

FIGURE 4.2.1-1.—*General Outcrop Pattern of Bedrock Formations on the Oak Ridge Reservation*

4.2.2 Soils

The ORNL typically lies on well to moderately well-drained soils underlain by shale, siltstone, silty limestone, and sandstone. Soil erosion from past land uses has ranged from slight to severe. Erosion potential is very high in those areas that have been eroded in the past with slopes greater than 25 percent. Erosion potential is lowest in the nearly flat-lying permeable soils that have a loamy texture. Additionally, wind erosion is slight, shrink-swell potential is low-to-moderate, and the soils are acceptable for standard construction techniques (DOE 1996a).

The soils occurring in the ORNL vicinity belong to the broad group of ultisols. Ultisols were formerly referred to as red-yellow podzolic and reddish brown lateritic soils. Entisols are found locally in steeply sloping areas. Entisols, formerly lithosols, consist of thin surface soils showing little development of soil horizons. These soils are moist, strongly leached, acid in reaction, and low in organic matter (DOE 1999c).

The depth of the soil within ORNL varies from 15 cm (6 in) in some of the shale and sandstone to 5 m (15 ft) or more in some of the dolomitic limestone areas. Depth to bedrock is limited to 15 to 90 cm (6 to 36 in) in the Bethel Valley area where most activities would occur. The soil texture along the surface is generally silt loam or cherty silt loam. No prime farmland is located on the ORR because it is within the city limits of Oak Ridge (DOE 1996c).

4.2.3 Seismicity

The Oak Ridge area lies at the boundary between seismic Zones 1 and 2 of the Uniform Building Code, indicating that minor to moderate damage could be expected from an earthquake. Since the New Madrid earthquakes of 1811 to 1812, at least 26 other earthquakes with a modified Mercalli intensity, herein referred to as intensity of III to VI, have been felt in the Oak Ridge area, the majority of these having occurred in the Valley and Ridge Province. The Charleston, South Carolina earthquake of 1886 had an intensity of VI at Oak Ridge and an earthquake centered in Giles County, Virginia in 1886 produced an intensity of IV to V at Oak Ridge. One seismic event close to ORR occurred in 1930; its epicenter was 8 km (5 mi) from ORR (DOE 1996a). This earthquake had an estimated intensity of VII at the epicenter and an approximate intensity of V to VI in the Oak Ridge area. Recorded ground acceleration at ORR was less than 0.01 gravity. A maximum horizontal ground surface acceleration of 0.19 gravity at ORR is estimated to result from an earthquake that could occur once every 2,000 years.

The magnitude of the largest recorded earthquake in eastern Tennessee registered 4.6 on the Richter scale. This earthquake occurred in 1973 in Maryville, Tennessee, 34 km (21 mi) southeast of ORR, and had an estimated intensity of V to VI in the Oak Ridge area (DOE 1996a). In 1987, a significant earthquake occurred approximately 48 km (30 mi) from ORR with an intensity of VI. In addition, since 1995, two earthquakes with an intensity of III, and two other earthquakes with an intensity of V occurred within 166 km (100 mi) from the ORR (NEIC 1999). The largest recent earthquake recorded in the area was on June 17, 1998 with the epicenter located at the ORR ETTP. This earthquake was widely felt, with a magnitude of 3.6 on the Richter scale (II to III on the Modified Mercalli scale).

4.3 WATER RESOURCES

The potential activities being considered under Alternatives 2, 3 and 4 could affect portions of three ORR watersheds: Bethel Valley, Melton Valley, and Upper East Fork Poplar Creek (UEFPC). Water resources include groundwater and surface water.

4.3.1 Groundwater Resources

The ORR is located within an area of sedimentary rock units with widely varying hydrological characteristics. Two geologic units, the Knox Group and the Maynardville Limestone of the Conasauga Group, both consisting of dolostone and limestone, constitute the Knox Aquifer. A combination of fractures and solution conduits in this aquifer control flow over substantial areas and relatively large quantities of water may move rapidly over relatively long distances. The Knox Aquifer is also the primary source of groundwater infiltration to many streams (base flow), and most large springs within the ORR receive discharge from this aquifer. The yield of some wells penetrating larger solution conduits are reported to exceed 1,000 gallons per minute (GPM). The remaining geologic units commonly encountered on the ORR (e.g., the Rome Formation, Conasauga Group below the Maynardville, and the Chickamauga Group) are aquitards (units inhibiting water flow and not holding much water) that consist mainly of siltstone, shale, sandstone, and interbedded limestone and dolostone of low to very low permeability. Nearly all groundwater flow in the aquitards occurs through fractures similar to the dominant aquifer zones. However, lack of development of solution-enlarged fractures and smaller, less connected fracture systems in the aquitards greatly limits flow in the system. In many areas underlain by aquitards, topographic relief and poor water transmissivity result in only shallow groundwater flow and local discharge to nearby surface waters within the ORR (DOE 2000c).

The Knox Aquifer and ORR Aquitards can each be divided into a shallow soil and regolith unit and a deeper bedrock unit. The shallow unit includes man-made fill, alluvium, colluvium, residuum, and weathered bedrock. In undisturbed areas a storm-flow zone, roughly consistent with the local root zone of plants, carries a large percentage of infiltration precipitation toward surface water streams. The influence of man-made fill on groundwater flow within the shallow unit is particularly important where pre-existing stream channels have been filled or along buried pipelines that act as preferential groundwater flow pathways.

There are no Class I sole-source aquifers beneath the ORR. In general, all ORNL aquifers are considered Class II - current potential sources of drinking water, although low well yield and high background levels of manganese have disqualified some areas of Bethel Valley from this category. Because of the abundance of surface water and its proximity to the point of use, very little groundwater is used at ORR. Background groundwater quality at ORR is generally good in the near surface zones and poor in the bedrock aquifer at depths greater than 305 m (1,000 ft) due to high total dissolved solids.

Groundwater in Bethel Valley

Bethel Valley is underlain primarily by rocks of the Chickamauga Group that consist of interbedded limestones and siltstones dipping 30 to 40 degrees. Bedding plane partings, which frequently occur in the more limestone-rich formations such as the Rockdell, Benbolt, and Witten, are the most abundant fracture features that affect flow within the Chickamauga Group. The formations are also subject to chemical weathering and dissolution resulting in karst features, including cavities and conduits, that strongly influence groundwater flow and transport of contaminants. However, studies have also shown that in the shallow groundwater zone some pipeline trench backfill is more permeable than the surrounding soil and provides a preferred pathway for groundwater flow and contaminant transport (Jacobs 1998).

Historic processes, programs, and waste management practices associated with laboratory operations have led to areas of groundwater contamination in Bethel Valley. Groundwater quality in Bethel Valley has been characterized during CERCLA investigations. Some areas of groundwater plume development extend near facilities and Brownfield areas being considered as part of the alternatives. Common contaminants detected in groundwater include volatile organic compounds (VOCs) (mostly solvents i.e., trichloroethene, tetrachloroethene, 1, 1-dichloroethene, benzene, and vinyl chloride) near the east end of ORNL; metals (primarily mercury) and an array of radionuclides are common contaminants detected under or near the central and west end of ORNL. Contamination has not been identified, but may be present under areas under consideration for FRP construction in Alternatives 3 and 4.

Groundwater in Melton Valley

Melton Valley is underlain primarily by aquitards consisting mainly of siltstone, shale, sandstone, and thinly bedded limestone of low to very low permeability. Groundwater that occurs moves through fissures in soil and bedrock. The groundwater table in most of the Melton Valley area is a subdued replica of the land surface; seepage occurs quickly from all slopes to adjacent streams. A relative continuous zone of groundwater contamination exists throughout Melton Valley. As presented in the Melton Valley Remedial Investigation Report, groundwater exceeds the *Safe Drinking Water Act* of 1972 maximum contamination level (MCL) in all 14 drainage basins that comprise the Melton Valley watershed. Contaminated groundwater originated from source areas (i.e., seepage pits, waste disposal trenches, impoundments, etc.) typically follows shallow pathways to nearby surface water bodies. Contaminant concentrations are frequently higher near the water table in the near surface (vadose) zone, (DOE 1999f) than in deep wells. Limited FRP construction is proposed in the Melton Valley as part of Alternatives 3 and 4.

Groundwater at Y-12

Groundwater at Y-12 has been divided into three hydrogeologic regimes: Bear Creek, Chestnut Ridge, and UEFPC. The facilities potentially affected by the proposed plan all lie within the UEFPC hydrogeologic regime that is dominated by the ORR Aquitards. Groundwater flow is generally toward the stream channel and to the east. Groundwater recharge is most effective where overburden soils are thin or permeable, but much of the industrial areas where the facilities under consideration are located are covered by buildings and paved surfaces. Groundwater flow is generally parallel to bedding, but may not coincide with the direction of maximum hydraulic gradient calculated from field measurements, particularly in the aquitard units. In the aquitard, most groundwater flow occurs in a highly conductive interval near the bedrock/residuum interface (water table interval) and most flow occurs at depths less than about 30 m (100 ft).

Historical groundwater monitoring data in the UEFPC area has defined an area of contamination that extends from west to east beneath the industrial facilities at Y-12, including some of the facilities being considered under the alternatives. The most widespread contaminant types are: VOCs such as the solvents perchloroethylene (PCE), trichloroethene (TCE), 1,2 dichloroethene (DCE), carbon tetrachloride, and chloroform; fuel components such as benzene, toluene, ethylbenzene, and xylenes; and other contaminants such as nitrate, gross alpha activity (primarily uranium isotopes), and gross beta activity (primarily uranium isotopes and technetium-99). The most frequently detected metals include boron, beryllium, cobalt, copper, chromium, lead, lithium, mercury, manganese, nickel, and total uranium (DOE 1999d). None of the action alternatives (2, 3, or 4) would involve contact with this contaminated groundwater, unless it were as a result of deactivation activities.

4.3.2 Surface Water Resources

Surface water resources for the Bethel Valley, Melton Valley, and East Fork Poplar Creek (EFPC) watersheds are presented in Figure 4.3.2–1. The main ORNL site and both Brownfield and Greenfield areas under consideration in this assessment are located in the Bethel Valley watershed. The 7600 [Robotics and Process Systems Complex (RPSC)] and 7900 [HFIR/Radiochemical Engineering Development Center (REDC) complex] facilities are small sites [4 ha (10 acres) or less] that lie within two different areas of the Melton Valley watershed. Most of the facilities at Y-12 that would be placed into a “cheap-to-keep” program are located within the UEFPC watershed.

11x17

FIGURE 4.3.2–1.—*Surface Water in Potentially Affected Watersheds*

Bethel Valley Surface Water

White Oak Creek is the main receiving surface water body in Bethel Valley. Its watershed comprises approximately 849 ha (2,098 acres) of Bethel Valley and includes the following tributaries: Northwest Tributary (NWT) [drains Solid Waste Storage Area (SWSA) 3 and runs along the west side of the West Campus]; First Creek (divides the west end of ORNL from the central area and receives drainage from both); and Fifth Creek (runs through the middle of central ORNL and receives drainage from SWSA 2). The Bethel Valley hydrologic system is typically represented as the relationship between rainfall in the basin, imported water, evapotranspiration, changes in water storage, and discharge (measured at the 7500 Bridge weir). Important subsystems of the surface water hydrologic system include interflow, conduit flow, and groundwater discharge to streams. Streamflow data for White Oak Creek are collected from five monitoring stations shown in Figure 4.3.2–1. Table 4.3–1 provides the drainage areas and mean flows for the stream reaches monitored by each station. Surface water flow summary statistics for the key weir and facility discharge locations in Bethel Valley are shown in Table 4.3–2. These records show the relative importance of different areas within the watershed to the overall watershed discharge. Flow from White Oak Creek in Bethel Valley flows downstream to White Oak Lake, and eventually discharges to the Clinch River (DOE 1999c).

**TABLE 4.3–1.—Stream Reaches on White Oak Creek in Bethel Valley (CY 1994),
Bethel Valley Watershed, ORNL, Oak Ridge, Tennessee**

Subwatershed Reach	Area km ² (mi ²)	Contributing Tributaries Gauged/ungauged	CY 1994 mean flow L/second (ft ³ /second)
White Oak Creek headwaters	0.804 (1.29)	0/2	1.95 (55.22)
Upper White Oak Creek at GS6	1.29 (2.08)	0/2	2.43 (68.82)
White Oak Creek at GS5	2.09 (3.36)	0.4	6.83 (193.42)
First Creek at GS1	0.319 (0.51)	0.0	1.27 (35.97)
Northwest Tributary at GS4	0.667 (1.07)	0/2	1.41 (39.93)
7500 Bridge	3.26 (5.25)	2/0	12.4 (351.17)

Source: DOE 1995.

Part of the alternatives under consideration would occur in the west end of ORNL along the eastern perimeter of the West Bethel Valley area. This area is bounded to the west by Highway 95 and to the east by First Creek. The predominant surface water feature in West Bethel Valley is the NWT drainage basin that flows into White Oak Creek just south of the West Campus. Dry season flow in the NWT begins in the stream channel at an elevation of about 248 m (815 ft) above mean sea level (MSL) just north of SWSA 3. Wet season flow originates from many wet-weather springs and seeps located throughout the NWT basin, including a channel to the south of SWSA 3 that drains into the Closed Scrap Metal Area (CSMA, formerly known as WAG 3) and the SWSA 3 Area. Discharge from the NWT constitutes about one-fourteenth of the flow in White Oak Creek as it leaves Bethel Valley at the 7500 Bridge weir. Some potential contaminant sources were identified for the West Bethel Valley area: the SWSA 3, the CSMA, the Contractor's Landfill, and the West End Dump Site.

Additional information regarding facilities and contaminants in Bethel Valley surface water can be found in the RI/FS Report for the Bethel Valley watershed (DOE 1999c). The primary contaminants detected in White Oak Creek are cobalt-60 (⁶⁰Co), cesium-137 (¹³⁷Cs) and strontium-90 (⁹⁰Sr). Cobalt and cesium have been detected at a relatively low frequency (13 and 11 out of 120 samples, respectively) during routine

**TABLE 4.3-2.—Summary Statistics for Principal Weirs and Facility Discharges,
Bethel Valley Watershed, ORNL, Oak Ridge, Tennessee**

Location (record dates)	Minimum L/second (ft³/second)	1st quartile L/second (ft³/second)	Median L/second (ft³/second)	Mean L/second (ft³/second)	3rd quartile L/second (ft³/second)	Maximum L/second (ft³/second)
Northwest Tributary (1987-1995)	0.07 (0.0025)	10 (0.35)	25 (0.88)	32 (1.12)	48 (1.69)	125 (4.39)
First Creek (1990-1997)	14.43 (0.51)	27.92 (0.99)	49.42 (1.75)	74.58 (2.63)	111.9 (3.95)	269.3 (9.51)
Sewage Treatment Plant (1990-1997)	340 (12)	651 (23)	765 (27)	765 (27)	906 (32)	1,161 (41)
Nonradiological Wastewater Treatment Facility (1990-1997)	1,246 (44)	1,444 (51)	1,643 (58)	1,671 (57)	1,841 (65)	2,266 (80)
7500 Bridge (1987-1997)	1,529 (54)	6,230 (220)	11,894 (420)	15,576 (550)	22,090 (780)	56,640 (2,000)

Source: DOE 2000c.

monitoring from 1987 to 1997. Maximum concentrations of ⁶⁰Co and ¹³⁷Cs were 54.1 picocuries per liter (pCi/L) and 73.0 pCi/L, respectively. Total radioactive ⁹⁰Sr, on the other hand, was frequently detected (130 out of 131 samples) during the 1987 to 1996 time period. ⁹⁰Sr concentrations ranged from 0.703 to 104 pCi/L.

Some remodeling on the proposed addition to Building 3500 and proposed parking lots lie just to the west of Fifth Creek. Fifth Creek, which was completely rerouted from its original channel near the valley axis to its present path adjacent to Fifth Street, obtains its source water from several springs located north of Bethel Valley Road. The springs are fed from the Knox Aquifer on Chestnut Ridge. Fifth Creek also receives discharge from storm drains and groundwater inflows. The southern portion of this area is transected by White Oak Creek flowing east to west with a streambed elevation of about 236 to 238 m (775 to 780 ft) MSL. The Central Bethel Valley area (the main ORNL site) is highly developed, thus little of the original drainage patterns remain, and most drainage is via storm sewers. Numerous building sumps, drywells, and drains, and several lined and unlined impoundments have affected the natural discharge and recharge to surface water in the Central Bethel Valley area, and two liquid waste treatment facilities, the Process Waste Treatment Complex (Buildings 3544 and 3608), discharge into White Oak Creek through one National Pollutant Discharge Elimination System (NPDES) outfall. Surface water sampling and analyses are conducted in the 3000 south area as part of NPDES permits, however, no continuous flow monitoring data are available. The primary contaminants detected in the treatment plant effluent and NPDES samples include gross beta, ⁹⁰Sr, ¹³⁷Cs, tritium, and mercury.

Much of the remodeling activities in Alternatives 2, 3, or 4 would occur in the ORNL 4000 Area within Central Bethel Valley. This area consists of about 47 ha (115 acres) that lie to the east of Fifth Creek. The primary surface water features consist of White Oak Creek that flows east to west across the southern portion of east ORNL and the “Swan Pond” located adjacent to Eight Street and Bethel Valley Road. The headwaters of White Oak Creek lie further to the north, across Bethel Valley Road and along the southern flanks of Chestnut Ridge. Water balance calculations infer that water lost in the upper portions of the White Oak Creek streambed resurge along geologic strike into the “Swan Pond,” thus the pond is spring fed. Discharge from the pond travels through a storm drain southward to rejoin White Oak Creek. Fifth Creek flows along the

western boundary of the area and discharges into White Oak Creek. Multiple surface water samples have been collected from various stations in the 4000 Area of ORNL; all but one were analyzed for mercury only. One station was analyzed for organic constituents in 1990, but none were detected. One source of mercury in White Oak Creek is transportation along Fifth Creek. Discharge from several sumps and gravity drains, particularly from around Buildings 4501/4505, is known to contain mercury concentrations up to 800 micrograms per liter (ug/L). Much of the sump discharge is released directly to White Oak Creek without treatment.

Melton Valley Surface Water

New facilities could potentially be constructed in the future under the FRP at the 7600 Area (RPSC) and the 7900 Area (HFIR/REDC complex) that lie within two different areas of Melton Valley. The 7600 Area lies at the far eastern end of Melton Valley along the banks of the Clinch River. The Clinch River is impounded approximately 16 km (10 mi) downstream from the site by Melton Hill Dam. The area is bordered to the north and west by small unnamed natural drainage features that discharge within a short distance directly into the Clinch River and its impounded backwaters. The Clinch River is used as a source of drinking water by local municipalities (DOE 1998b).

The 7900 Area lies between unnamed tributaries to Melton Branch on the southern flanks of Haw Ridge, directly south of the Central Bethel Valley area. The tributaries flow southward and discharge into Melton Branch that flows from east to west and discharges into White Oak Lake approximately 1.6 km (1 mi) west of the site.

Upper East Fork Poplar Creek Surface Water

The facilities at Y-12 that would be deactivated under Alternatives 3 and 4 are located within the UEFPC drainage basin. The upper reaches of the UEFPC drain the majority of the industrial facilities at Y-12. As shown in Figure 4.3.2-1, the upper reaches of UEFPC travel through the heavily industrialized portion of the Y-12 facilities. As such, the natural drainage pattern has been radically altered by construction activities. The western portion of the creek flows underground through pipes and the remaining portion flows in a modified and straightened channel lined with riprap and concrete. Flow in this portion of the UEFPC is derived partially from groundwater captured by the buried channels and funneled to the creek. In addition, plant outfalls into UEFPC add a combination of groundwater, stormwater, and water generated by plant operations (e.g., basement sumps, treatment discharges). Plant-wide efforts to reduce inadvertent direct discharges of contaminated water to UEFPC have resulted in reduced flow over the years. However, beginning in mid-1996, Y-12's NPDES permit required supplementing flow in UEFPC by the addition of raw water from the Clinch River. River water is added to UEFPC in order to maintain a flow of about 7 million gallons per day (MGD) at Station 17.

There are six treatment facilities with NPDES-permitted discharge points to UEFPC at Y-12. Y-12 is also permitted to discharge wastewater to the city of Oak Ridge Wastewater Treatment Facility. Efforts to reroute discharge pipes and to treat all wastewater from plant processes have improved surface water quality in UEFPC. However, stormwater discharges, groundwater discharges (either directly to the stream channel or collected in drains and sumps and discharged to UEFPC) and wastewater discharges still contribute contaminants to UEFPC including: metals (particularly mercury and uranium), chlorinated solvents, and radionuclides (especially isotopes of uranium) (DOE 1998c). These contaminants are being addressed through CERCLA.